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Revalidation of the genus *Thoracophelia* Ehlers, 1897, replacing *Euzonus* Grube, 1866 (Polychaeta: Opheliidae), junior homonym of *Euzonus* Menge, 1854 (Arthropoda: Diplopoda), together with a literature summary and updated listing of *Thoracophelia* species

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Brewer *et al.* (2011) recently demonstrated that the generic name *Euzonus* was being used in both Arthropoda (Diplopoda) and Polychaeta (Opheliidae) systematics and that the arthropod name was the senior synonym. The diplopod name *Euzonus* Menge, 1854, based on a single species, *E. collulum* Menge, 1854 from Baltic amber predates *Euzonus* Grube, 1866, established for *E. arcticus* Grube, 1866 from the Arctic Ocean. The *Nomenclator Zoologicus* (2005) verifies that both names are listed as uncorrected homonyms.

Brewer *et al.* (2011) suggested that for time being, the genus *Pectinophelia* Hartman, 1938 could be used for those species of Polychaeta currently referred to the genus *Euzonus*. However, prior to Hartman's (1956) referral of these opheliids to the genus *Euzonus*, some species had been included in the genus *Thoracophelia* Ehlers, 1897 and this is clearly the next available name for polychaetes currently referred to *Euzonus* Grube. In the following paragraphs I summarize some key decision points in the taxonomic history of these opheliids, their referral to *Thoracophelia*, and why subgenera, as currently applied, are not necessary.

The polychaetes that have been referred to *Euzonus* are unusual among the Opheliidae in having the body divided into three distinct regions: (1) an anterior cephalic region formed of the prostomium and first two setigers; (2) a swollen thoracic region, usually through setigers 2–10; and (3) a long narrow posterior region with a distinct ventral groove; sometimes the posterior pygidial region is enlarged or modified. Branchiae are limited to the posterior region, but are typically absent from the posteriormost segments. Santos *et al.* (2004) also noted that all species of these opheliids have a lateral modification of setiger 10, either as a flap arising from the body wall or with rows or patches of papillae. Two species referred to the genus *Lobochesis* Hutchings & Murray, 1984 also share these characters and were referred to *Euzonus* by Santos *et al.* (2004). This synonymy was further supported as part of a cladistic analysis of opheliids by Sene Silva (2007) who demonstrated that the two species of *Lobochesis* were nested within a monophyletic clade of *Euzonus* species.

The current arrangement of species and subgenera of the opheliids referred to *Euzonus* Grube date from Hartman (1938, 1944, 1956, 1959, and 1969). At time of Hartman's 1938 publication, these polychaetes were included in *Thoracophelia* Ehlers with four known species: *T. furcifera* Ehlers, 1897, *T. mucronata* (Treadwell, 1914), *T. ezoensis* Okuda, 1934, and *T. yasudai* Okuda, 1936. *Euzonus arcticus* Grube had not yet been recognized as belonging to this group of species, despite redescriptions and records of the species by Augener (1912) and Annenkova (1935). Hartman (1938) described two new species that had distinct pinnules arising from the branchiae and established a new genus, *Pectinophelia,* to accommodate them (*P. dillonensis* Hartman, 1938 and *P. williamsi* Hartman, 1938). She also referred both of Okuda's species to this new genus, leaving *T. furcifera* and *T. mucronata,* both with simple branchiae, in *Thoracophelia.* The generic separation among these six species was, therefore, based on the presence or absence of pinnules on the branchiae.

Hartman (1944) retained this classification but extended the range of *T. mucronata* from southern California, where it had originally been reported, to British Columbia where it had been found by Berkeley & Berkeley (1932). Hartman (1944) also reported *T. mucronata* from Dillon Beach, California, where both *Pectinophelia dillonensis* and *P. williamsi* were originally described. This was the first time that all three California species were noted to occur in the same area, sometimes in the same samples.

Hartman (1956) recognized *Euzonus* Grube, 1866, for the first time and referred all species of *Thoracophelia* and *Pectinophelia* to this genus. She retained the earlier branchial distinction through the use of two subgenera: *Euzonus* (*Thoracophelia*) for species having simple branchiae and *Euzonus* (*Euzonus*) for species having branchiae with pinnules.

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Pectinophelia became a junior synonym of *Euzonus*. This genus-subgenus arrangement was retained in her later publications (Hartman 1959, 1969).

Subgenera were not used by Blake (1975, 2000) or Blake & Ruff (2007) for the three California *Euzonus* species. Santos *et al.* (2004) did not use subgenera or discuss the issue as part of their review of the genus and descriptions of two Brazilian species.

The use of subgenera was shown to be invalid by Parke (1973), who was able to collect all three California species at Dillon Beach and studied their morphology, reproduction, larval development, and general ecology based on field and laboratory experiments. This work built upon earlier studies on *Thoracophelia mucronata* biology from southern California by McConnaughey & Fox (1948) and Dales (1952). Parke (1973) found that the species with the greatest degree of pinnule development and largest respiratory surface, *E. dillonensis,* occurred highest in the intertidal zone where exposure and oxygen stress was greatest; likewise *E. mucronata*, with no pinnule development, occurred lower in the intertidal where there was less exposure and oxygen stress at low tide. *Euzonus williamsi* was observed to be intermediate both in branchial morphology and position in the intertidal and exhibited the most variability in pinnule development. Cross-breeding experiments by Parke (1973) revealed that each species × species combination resulted in successful hybridization, albeit with a low degree of compatibility for some crosses. In most crosses, larvae were successfully reared to the settlement stage. However, the presence of three distinct, yet very closely related species was supported because each was largely isolated in the field from hybridization due to temporal differences in gamete maturation (Parke 1973). These three sympatric species are therefore maintained by habitat preference and temporal reproductive isolation. The development of pinnules on the branchiae is therefore, a species-level adaptation to habitat and subgenera are not necessary. Modern genetic studies are required in order to better understand the maintenance of three species of *Thoracophelia* in the dynamic, open beach habitat at Dillon Beach.

The species of Opheliidae formerly referred to *Euzonus* Grube must be referred to *Thoracophelia* Ehlers. A revised classification is as follows:

Genus *Thoracophelia* Ehlers, 1897: Type-species: *Thoracophelia furcifera* Ehlers, 1987

Euzonus Grube, 1866, Type-species *E. arcticus* Grube, 1866 (Polychaeta, Opheliidae); junior homonym of *Euzonus* Menge, 1854, Type species *E. collulum* Menge, 1854 (Arthropoda, Diplopoda)

Pectinophelia Hartman, 1938: Type-species *P. dillonensis* Hartman, 1938

Lobochesis Hutchings & Murray, 1984: Type-species *L. bibrancha* Hutchings & Murray, 1984

Known species in the order of description with type localities are:

Thoracophelia arctica (Grube, 1866), new combination. Arctic Ocean.

Thoracophelia furcifera Ehlers, 1897. Patagonia.

Thoracophelia mucronata Treadwell, 1914. Southern California.

Thoracophelia ezoensis Okuda, 1934. Northern Japan.

Thoracophelia yasudai Okuda, 1936. Northern Japan. Referred to *Euzonus arcticus* by Annenkova (1935) and Imajima & Hartman (1964); treated as a distinct species by Uschakov (1955) and Hartman (1959).

Thoracophelia dillonensis (Hartman, 1938), new combination. Dillon Beach, California.

Thoracophelia williamsi (Hartman, 1938), new combination. Dillon Beach, California.

Thoracophelia flabellifera Zeigelmeier, 1955. North Sea.

Thoracophelia profunda (Hartman, 1967), new combination. Off Cape Horn, South America, 4008 m.

Thoracophelia heterocirra (Rozbaczylo & Zamorano, 1970), new combination. Eltabo, Chile.

Thoracophelia otagoensis (Probert), 1976, new combination. Otago Peninsula, New Zealand.

Thoracophelia bibrancha (Hutchings & Murray, 1984), new combination. Merimbula, New South Wales, Australia

Thoracophelia longiseta (Hutchings & Murray, 1984), new combination. Ocean Beach, New South Wales, Australia.

Thoracophelia zeidleri (Hartmann-Schröder & Parker, 1995), new combination. Haystack Beach, Reevesby Island, South Australia.

Thoracophelia japonica (Misaka & Sato, 2003), new combination. Oura Bay, Shimoda, Izu Peninsula, Japan.

Thoracophelia mammallata (Santos, Nonato, & Petersen, 2004), new combination. N and NE Brazil, intertidal

Thoracophelia papillata (Santos, Nonato, & Petersen, 2004), new combination. SE Brazil, shelf depths.

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